

### **DETAILED ACTION**

1. During the telephone interview with the applicant on March 3 and 4, 2008, the applicant explained the submission of the IDS which is submitted without fee. Therefore, the Final Rejection mailed on 02/21/2008 is withdrawn. A new Final Rejection is following. And the previously set period for reply is restarted.

### ***Information Disclosure Statement***

2. The information disclosure statement (IDS) submitted on 9/11/2007 is being considered by the examiner.

### ***Response to Arguments***

3. Applicant's arguments with respect to claims 1, 3, 4, 7-12, 14 and 18 have been considered but are moot in view of the new ground(s) of rejection.

1). Applicant's argument – "it is respectfully submitted that the Office Action has not conducted the analysis required by MPEP 2181-2183 to show that the means-plus-function limitations of the claims can be found in the prior art".

Examiner's response – In the original disclosure, the applicant states "the signal, after being amplified to constant level at amplifier circuit 6, is separated into clock signal CK and time-divided signal(s) at output signal separation circuit 7"; the original disclosure discloses a "black-box" circuit and does not disclose the detail or "the corresponding structure" of the signal separation circuit; and in the specification, the

applicant also does not disclose the "the corresponding structure" of the distinguishing means at the input side.

2). Applicant's argument – "The structure of Osako's drive circuit is not disclosed in Osako. It is therefore not clear from Osako what would happen if the amplitude of pulses applied to the drive circuit were varied. If the pulses, for example, merely control the state of a transistor in the drive circuit to control power to the photodiode, varying the amplitude of pulses input to the drive circuit would not affect the optical intensity of the light output by the photodiode.

Examiner's response – As admitted by the applicant, only "If" the pulses merely control the state of a transistor in the drive circuit to control power to the photodiode, varying the amplitude of pulses input to the drive circuit would not affect the optical intensity of the light output by the photodiode. However, Osako does not state that the pulses merely control the state of a transistor. And Osako does not state that the driving circuit that affect the optical intensity of the light output by the photodiode cannot be used in the photo coupler system.

3). Applicant's argument – "Moreover, since Osako always uses separate photodiodes for data and for clock signals, it is not clear why one skilled in the art would be motivated to change the optical intensities of these light signals. Furthermore, Osako is not directed to a multiplexing application, and there appears to be no need to "relax bandwidth requirements" in Osako.

Examiner's response – Osako uses a time-division-multiplexing technique, that is Osako is directed to a multiplexing application. To change the optical intensities of the

light output from the light emitting element is to get the level-coupled signals or the amplitude modulation multiplexed signal so to "relax bandwidth requirements".

4). Applicant's argument – "Slater therefore fails to satisfy this second prong of the *Oetiker* test, and is therefore non-analogous art". "Schimpf is also submitted to be non-analogous art. Schimpf is directed to a multiplexing system for transmitting multiple video signals over a single transmission channel".

Examiner's response – In response to applicant's argument that Slater and Schimpf are nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, both the claimed invention and the references are related to use the pulse amplitude modulation (PAM) multiplexing to transmit a plurality of signals over a single channel. The claimed invention uses the level-coupling or the PAM to consolidate four channels into a single signal (level-coupled signal). One of ordinary skill in the photocoupler art faced with the problem of many light-emitting and receiving elements and circuits in multichannel photocoupler would look to the solutions of others faced with the similar problems, and therefore the references were in an analogous art.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 12 and 14 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 12, and thus depending claim 14, recites the limitation "**a first light-emitting element** communicating said time-divided signal from said input side to said first light-receiving element on said output side at a first light intensity; and **a second light-emitting element** communicating said clock signal from said input side to said second light-receiving element on said output side at a second light intensity different than said first light intensity, said clock signal **being superimposed** on said at least one time-divided signal". The original disclosure discloses that "a signal is generated through superposition of clock signal CK of high signal level simultaneous with signals of respective channels, this signal being communicated from light-emitting element 4 to light-receiving element 5" (page 9, paragraph [0042]). That is, the clock signal and the signals of respective channels are sent by a single light emitting element. The original disclosure does not teach that the clock signal from one light emitting element and the signals of respective channels from another light emitting element are **superimposed** and transmitted to the one or two light receiving element.

6. Claims 12 and 14 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 12, and thus depending claim 14, recites the limitation **"a first light-emitting element** communicating said time-divided signal from said input side to said first light-receiving element on said output side at a first light intensity; and **a second light-emitting element** communicating said clock signal from said input side to said second light-receiving element on said output side at a second light intensity different than said first light intensity, said clock signal **being superimposed** on said at least one time-divided signal". The original disclosure discloses that "a signal is generated through superposition of clock signal CK of high signal level simultaneous with signals of respective channels, this signal being communicated from light-emitting element 4 to light-receiving element 5" (page 9, paragraph [0042]). That is, the clock signal and the signals of respective channels are sent by a single light emitting element. The original disclosure does not teach how to superimpose the clock signal from one light emitting element and the signals of respective channels from another light emitting element.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1, 3, 4, 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Osako (US 4,253,048) in view of Reinhold et al (US 6,587,062) and Matsumura et al (JP48-91909) and Tanuma (JP02-131640).

1). With regard to claim 1, Osako discloses a multichannel photocoupler (Figure 3 or Figure 6) comprising:

at one or more input sides: one or more time division means (the Parallel to Serial Converter 102 in Figure 3, or 206 in Figure 6. The parallel to serial converter converts a stream of multiple data elements, receiver simultaneously, into a stream of data elements transmitted in time sequence. Or according to the "Fiber Optics Standard Dictionary", third Edition, by Martin Weik, the parallel to serial converter is a device that converts a group of simultaneous inputs on two or more parallel channels, often constituting a specific data unit, such as a byte or word, into corresponding time-sequenced signal elements on a single channel. Therefore, the Parallel to Serial Converter is a time division means) for subjecting one or more input signals at one or more respective channels to time division; and

a light-emitting element (68 in Figure 3, or 306 in Figure 6) communicating at least one of the time-divided signal or signals to one or more output sides;

at one or more output sides: a light-receiving element (72 in Figure 3, or 310 in Figure 6) receiving at least one of the time-divided signal or signals from the light-emitting element; and

one or more output signal separation means (the Serial Parallel Converter 104, or 214 in Figure 6) for decoding at least one of the time-divided signal or signals and for outputting same to at least one of the respective channel or channels;

the multichannel photocoupler further including one or more synchronization means (the timing Pulse Generator 106 in Figure 3, or 302 in Figure 6) for synchronizing the one or more input sides and one or more output sides through use of one or more prescribed clock signals transmitted simultaneously with at least one of the time-divided signal or signals (Osako teaches that the time pulse generator is coupled to the parallel-serial converter; and in synchronism with the timing pulse from the timing pulse generator, the parallel-serial converter converts the bit parallel digital signal to the bit serial digital signal, column 5, line 41-44; and for Figure 6, the timing pulse generator provides timing pulses to the parallel-serial converter and the drive circuit 316, column 7 line 8-33); and

But, in Figure 6, Osako teaches that one photocoupler transmits time-divided signal, and another photocoupler transmits the clock signal.

Osako does not disclose (A) the one or more prescribed clock signals transmitted simultaneously with and superimposed on at least one of the time-divided signal or signals; (B) one or more distinguishing means for distinguishing one or more clock signals from one or more time-divided signals comprising, for at least one of the input

side or sides, means for varying one or more electric current flowing at the light-emitting element so to impart one or more differences to one or more optical intensities in one or more clock synchronization signals and one or more time-divided signals.

With regard to item (A), however, to transfer the prescribed clock signals (or the clock synchronization signals) simultaneous with time-divided signals are well known in the art. Reinhold et al teaches a system and method to transfer clock synchronization signals (Figure 7, the signal Data 14 includes both clock timing signal and the data signal, column 9 line 23-38) simultaneous with and superimposed on other respective signal channels through use of the single optical coupler.

Reinhold et al discloses that because both the clock information and the data information can be coupled to the DSP or digital filter using only a single optical isolator or other galvanic isolation device. This results in substantial cost savings, because galvanic isolation devices generally are very expensive.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use one emitting diode to transmit both the data signal and clock signal as taught by Reinhold et al to the system of Osako so that the clock signal transmitter comprises the first light-emitting element and the clock signal receiver comprises the first light-receiving element, and then the system cost can be reduced.

With regard to item (B), Reinhold et al uses a DSP to receive the clock signal and data signal, that is, the DSP must recognize the clock signal and the data signal so that the whole system is functional and working properly. It is inherent that the system (Figure 7) of Reinhold has a distinguishing means, for the input side, for distinguishing



the clock signals from the data signal, otherwise the DSP will not be able to distinguish the clock and data signals, and the system does not work as its desired function.

But Reinhold does not expressly teach that the distinguishing means comprises means for varying one or more electric current flowing at the light-emitting element so to impart one or more differences to one or more optical intensities in one or more clock synchronization signals and one or more time-divided signals.

However, Matsumura et al teaches a distinguishing means for distinguishing one or more clock signals from one or more time-divided signals (Figure 1, Matsumura et al teaches that the synchronization signal is made higher in amplitude level than a TDM signal so that the synchronization signal and the TDM signal are readily separated from each other).

Another prior, Tanuma, also teaches a system and method to transfer clock synchronization signals (Figure 7, the signal Data 14 includes both clock timing signal and the data signal, column 9 line 23-38) simultaneous with and superimposed on other respective signal channels through use of the single optical coupler; and one distinguishing means (the A/D converter 12) for distinguishing one or more clock signals from the amplitude modulated signals comprising, for at least one of the input side or sides, means for varying one or more electric current flowing at the light-emitting element so to impart one or more differences to one or more optical intensities in one or more clock synchronization signals and the amplitude modulated signals (Figure 7, 9 and 10, the D/A converter 12 varies the electric current flowing at the light-emitting element 15 so to impart differences to one or more optical intensities in the clock

synchronization signals (refer "1\*\*\*\*" of Figure 9) and the amplitude modulated signals (refer "00000" to "01111" of Figure 9), the clock signal has the highest intensity).

Therefore, it would be obvious to one skilled in the art to apply the system and method for varying the electric current flowing at the light-emitting element to impart one differences to optical intensities in the clock signals and data signals as taught by Matsumura et al and Tanuma so impart one or more differences to the optical intensities in the clock synchronization signals and the time-divided signals, and transmit the clock and data signals by a single optical coupler, and reduce the system size and cost.

2). With regard to claim 3, Osako and Reinhold et al and Matsumura et al and Tanuma discloses all of the subject matter as applied to claim 1 above. And Osako and Reinhold et al and Matsumura et al and Tanuma further disclose wherein: at least one of the synchronization means (the timing Pulse Generator 106, or 302 in Figure 6 of Osaka) generates one or more start bits before one or more time-divided signals (Matsumura et al: Figure 1, a synchronization means generates the start bit of clock signal before one or more signals at one or more first channels); and

at least one of the synchronization means at at least one of the output side or sides possesses functionality for detecting at least one of the start bit or bits (Osako teaches that the DSP receives and processes the data and clock signals, it is obvious to one skilled in the art that the DSP possesses functionality for detecting at least one of the start bit or bits).

3). With regard to claim 4, Osako and Reinhold et al and Matsumura et al and Tanuma discloses all of the subject matter as applied to claim 1 above. And Osako and

Reinhold et al and Matsumura et al and Tanuma further disclose wherein the synchronization means comprises:

at at least one of the input side or sides: a clock-signal-transfer light-emitting element (the light-emitting diode in photocoupler 318) other than the light-emitting element for transfer of one or more signals; and

at at least one of the output side or sides: a clock-signal-transfer light-receiving element (the photo-transistor in photocoupler 318) other than the light-receiving element for transfer of one or more signals.

4). With regard to claim 12, Osako discloses a multichannel photocoupler (Figure 6) comprising:

an input circuit (the A-D Converter 204 and the Parallel Serial Converter 206 in Figure 6) for receiving at least one input electrical signal;

a time division circuit (the Parallel to Serial Converter 206 in Figure 6) for time dividing said at least one input signal to produce a time divided signal;

an output side comprising a first light-receiving element (310 in Figure 6) and a second light-receiving element (the photo-transistor in 318 of Figure 6);

a first light-emitting element (306 in Figure 6) communicating said time-divided signal from said input side to said first light-receiving element on said output side at a first light intensity (Figure 6, the light emission diode 306 transmits the time-divided signal from the input side to the photo-transistor 310 on the output side at a first light intensity);

a second light-emitting element (the light emission diode in 318) communicating said clock signal from said input side to said second light-receiving element on said output side at a second light intensity different than said first light intensity (Figure 6, the light emission diode 318 transmits the clock signal from the input side to the photo-transistor in 318 on the output side at a second light intensity), said clock signal being superimposed on said at least one time-divide signal (the clock signal and the data signal are in synchronization); and

an output signal separation circuit (the Serial Parallel Converter 214 in Figure 6) for decoding said time-divided signal and outputting the decoded time divided signal as an electrical output signal.

Osako does not expressly state that the second light emitting element transmits light of a second intensity different than the first light intensity. However, since the drive circuit (e.g., 304 in Figure 6) of the first light emitting element transmits light and the drive circuit (e.g., 316 in Figure 6) of the second light emitting element are individual devices, the current generated by the two devices are different, therefore, the intensities from the two light emitting elements are indeed different.

Also, since the second light emitting element is used to transmit the clock signal, it is obvious to one skilled in the art to apply less power to the second light emitting element than the first light emitting element so to reduce the interference to the signal channels.

5). With regard to claim 14, Osako and Reinhold et al and Matsumura et al and Tanuma discloses all of the subject matter as applied to claim 12 above. And Osako

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further discloses wherein said input circuit comprises a clock signal transmitting circuit (the light-emitting diode in photocoupler 318) and said output circuit comprises a clock signal receiving circuit (the photo-transistor in photocoupler 318), and

But, Osako does not expressly disclose wherein said clock signal transmitting circuit transmits a start bit and said clock signal receiving circuit is adapted to detect said start bit.

However, Matsumura et al teaches a system and method in which the clock signal transmitting circuit transmits a start bit (Figure 1, clock signal at the start bit before other signals of the data.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the synchronizing signal at the start bit as taught by Matsumura et al to the system of Osako so that the clock signal and the data signal can be easily distinguished.

9. Claims 7 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Osako (US 4,253,048) in view of Slater (US 3,611,332) and Schimpf (US 3,492,432).

1). With regard to claim 7, Osako discloses a multichannel photocoupler comprising:

at one or more input sides: a light-emitting element (68 in Figure 3, or 306 in Figure 6) transferring one or more signals to at least one of the output side or sides; and

at one or more output sides: a light-receiving element (72 in Figure 3, or 310 in Figure 6) receiving one or more signals imparted with one or more changes in one or more optical intensities produced by the light-emitting element; and

one or more output signal separation means (the Serial Parallel Converter 214 in Figure 6) for decoding at least one of the signal or signals and for outputting same to at least one of the respective channel or channels.

But, in Figure 6, Osako uses time-division multiplexing to transmit multi-channel signals. Osako does not expressly disclose one or more level coupling means for carrying out level coupling with respect to one or more input signals at at least one of the respective channel or channels so as to impart one or more changes in one or more optical intensities at the light-emitting element and for causing same to be transferred to at least one of the output side or sides.

However, a level-coupled signals or the pulse amplitude modulation multiplexing is well known and widely used in the art for channels multiplexing so to transmit multi-channels through a single transmitter, such as disclosed by Slater and Schimpf. Slater teaches a system and method for multiplexing several channels (Figures 1 and 2) using pulse amplitude modulation multiplexing. Another prior art, Schimpf, also teaches the pulse amplitude modulation multiplexing for multichannels (Figure 2, column 2, line 6-16).

By using the multiplexing techniques, a plurality of signals or channels can be transmitted over a single channel. The number of transmitting and receiving elements can be reduced. Slater and Schimpf also teach that the pulse amplitude modulation multiplexing has a considerable saving in bandwidth requirements. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the level-coupling or pulse amplitude modulation multiplexing techniques as

taught by Slater and Schimpf to the system of Osako so that the system cost can be reduced and the size of the system can be reduced too.

2). With regard to claim 18, Osako discloses a multichannel photocoupler comprising:

an input circuit (the A-D Converter 204 and the Parallel Serial Converter 206 in Figure 6) for receiving at least one electrical input signal and including a first light-emitting element (306 in Figure 6);

an output circuit (the Serial Parallel Converter 214 and D-A converter 216 in Figure 6) comprising a first light-receiving element (310 in Figure 6) receiving a signal from said first light-emitting element;

an output signal separation circuit (the Serial Parallel Converter and D/A Converter) for decoding and outputting said signal.

But, Osako does not expressly disclose a level coupling circuit for level coupling said at least one electrical input signal and changing an optical intensity at the light-emitting element.

However, a level-coupled signals or the pulse amplitude modulation multiplexing is well known and widely used in the art for channels multiplexing so to transmit multi-channels through a single transmitter, such as disclosed by Slater and Schimpf. Slater teaches a system and method for multiplexing several channels (Figures 1 and 2) using pulse amplitude modulation multiplexing. And another prior art, Schimpf, also teaches the pulse amplitude modulation multiplexing for multichannels (Figure 2, column 2, line 6-16).

By using the multiplexing techniques, a plurality of signals or channels can be transmitted over a single channel. The number of transmitting and receiving elements can be reduced. Slater and Schimpf also teach that the pulse amplitude modulation multiplexing has a considerable saving in bandwidth requirements. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the level-coupling or pulse amplitude modulation multiplexing techniques as taught by Slater and Schimpf to the system of Osako so that the system cost can be reduced and the size of the system can be reduced too.

10. Claims 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Osako and Slater and Schimpf as applied to claim 7 above, in further view of Geller (US 5,502,298).

Osako and Slater and Schimpf disclose all of the subject matter as applied to claim 7 above. But, Osako does not expressly disclose the multichannel photocoupler further comprising: one or more monitor light-receiving elements provided at least one of the input side or sides; wherein one or more changes over time in one or more optical intensities at the light-emitting element is fed back to at least one of the level coupling means.

However, to monitor the output power of a the light-emitting element is a widely practice in the art so to control/stabilize the output power. Geller teaches such a monitor diode (Figure 3, column 4, line 5-23).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a monitor diode as taught by Geller to the system



of Osako and Slater and Schimpf so that the output power of the light-emitting element can be controlled and the level-coupled signals can be demodulated.

11. Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Osako and Reinhold et al and Matsumura et al and Tanuma as applied to claims 1, 3 and 4 above, in further view of Noda et al (US 2002/0125837).

Osako and Reinhold et al and Matsumura et al and Tanuma disclose all of the subject matter as applied to claims 1, 3 and 4 above. Osako further discloses wherein: one or more output stages at at least one of the respective channel or channels comprises one or more transistor elements (the photo-transistor 72 and 310).

But, Osako does not expressly disclose wherein: one or more output stages at at least one of the respective channel or channels comprises one or more thyristor elements; or triac elements.

However, the thyristor or triac elements are well known in the art. Noda et al teaches that both thyristor and triac can be used at the output stages of the photocoupler (page 4, [0054]). Therefore, it would have been obvious that the thyristor or triac elements can be used in the system of Osako et al. The limitations in claims 9-11 do not define a patentably distinct invention over that in Osako and Reinhold et al and Slater and Schimpf and Geller since both the invention as a whole and Osako and Reinhold et al and Slater and Schimpf and Geller are directed to couple multiple channels by a single photocoupler. Therefore, to use a transistor or thyristor or triac would have been a matter of obvious design choice to one of ordinary skill in the art.

12. Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Osako and Slater and Schimpf and Geller as applied to claims 7 and 8 above, and in further view of Noda et al (US 2002/0125837).

Osako and Slater and Schimpf and Geller disclose all of the subject matter as applied to claims 7 and 8 above. Osako further discloses wherein: one or more output stages at at least one of the respective channel or channels comprises one or more transistor elements (the photo-transistor 72 and 310).

But, Osako does not expressly disclose wherein: one or more output stages at at least one of the respective channel or channels comprises one or more thyristor elements; or triac elements.

However, the thyristor or triac elements are well known in the art. Noda et al teaches that both thyristor and triac can be used at the output stages of the photocoupler (page 4, [0054]). Therefore, it would have been obvious that the thyristor or triac elements can be used in the system of Osako et al. The limitations in claims 9-11 do not define a patentably distinct invention over that in Osako and Slater and Schimpf and Geller since both the invention as a whole and Osako and Reinhold et al and Slater and Schimpf and Geller are directed to couple multiple channels by a single photocoupler. Therefore, to use a transistor or thyristor or triac would have been a matter of obvious design choice to one of ordinary skill in the art.

***Conclusion***

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LI LIU whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Li Liu  
March 4, 2008

/Kenneth N Vanderpuye/

Supervisory Patent Examiner, Art Unit 2613